GAS JOURNAL, FEB. 9, 1944

VOL. 243 96th YEAR No. 4212

EDITORIAL NOTES

THE B.G.A.

WE feel almost that we ought to apologise for having made no editorial comment on the draft Constitution and Rules of the proposed British Gas Association which has been widely circulated and is being everywhere discussed in the Industry. In matters of national importance the man in the street looks to the national Press for analysis and discussion of issues, which help him to sum up and form his own judgment. We believe that the Gas Industry is entitled to expect a similar service from its own Press, and indeed that such service would be beneficial to it in that we have no particular district, sectional, or political interest, but can truly take a detached view of the big issues which affect the Industry. Such, however, is not the opinion of the authorities, and in the present case our application for a copy of the Draft has not been granted. If this attitude towards the "JOURNAL" is generally approved, well and good. We are quite certain, however, that it is not.

In other columns of this issue we publish a Memorandum by courtesy of a Correspondent who has carefully analyzed some of the outstanding points in the Draft. We think this may be of use to those who have the matter under consideration.

ELECTRICITY PLANS

THE electricity industry has been extremely active during the past few months planning for post-war development, and has carried out its work in this respect with no little optimism and assurance. We have recorded that the British Electrical Development Association is seeking a director who (in the words of an interim statement on after-war policy) will "act as an ambassador of the industry in all matters of supply and utilization affecting 10,500,000 consumers." Lines of development envisaged are standardization of voltages and of forms of tariff, easy facilities for hire purchase of apparatus and the maintenance of this apparatus, extension of the industrial off-peak load, increased technical and domestic service, and schemes of "guiding" the public—whatever "guiding" may mean. We have had the report of the Electrical Power Engineers' Association, a body representing the technical staffs in the industry, urging that the industry should be brought under unified public control, recommending that the Government should provide by legislation for the appointment of a National Electricity Supply Board with power to acquire all statutory electricity undertakings, maintaining that the country should be divided into distribution regions, each under the control of an engineer and manager appointed by the Board, which, it is proposed, should take over the Electrical Development Association.

Then, a matter of weeks ago, the Association of Electric Power Companies (in 1939, company undertakings supplied about 40% of the country's total electricity) put forward its own report, recommending, *inter alia*, a postponement of compulsory transference of undertakings to public ownership beyond the 50-year term envisaged by the McGowan Committee in 1936. Nor has all this planning activity neglected the question of research. There has been the adoption by the Post-War Planning Committee of the Institution of Electrical Engineers of a recommendation to set up a British Electrical Research Board to "act as a secretariat," and "fostering co-operation with Government departments." And only last week the announcement was made by the British Electrical and Allied Industries Research Association of the decision of its Council to buy a site for laboratories adjacent to the one already secured by the British Coal Utilization Research Association at Leatherhead, the while the Gas Research Board—apart from the room occupied by its Director in one of the corridors of Gas Industry House—has no accommodation, and would appear to be treading water rather than vigorously striking out to a goal.

Only a week ago, too, a report was published by the Institution of Electrical Engineers on post-war reorganization of electricity supply—a document of a factual and technical nature. First and foremost, the report urges, there should be standardization of voltage (230v. A.C.) throughout the country. On the basis of 1939 conditions and prices the cost is estimated at £17,500,000. The I.E.E. is not in the least worried about cost, however. The whole matter should be treated as "a national industrial plan so as to evoke the enthusiasm and goodwill of the consumer, the undertaker, and the manufacturing industry in co-operating to complete the plan in the minimum possible time." It is suggested, moreover, that as the benefit of standardization accrues to the community as a whole, there should be financial discussions with the Government. In other words, we take it, there would be no objection at all to the Gas Industry and the gas consumer helping to foot the bill. The report discusses rural development of electricity, and here again "it is generally agreed that some financial aid may be needed if the completion of rural electrification throughout the country as a whole is to be expedited." The question of tariffs is dealt with at some length, and it is suggested that the Electricity Commissioners should be authorized to permit any undertaking to offer a two-part tariff only, with no alternative flat rate.

To round off this briefest of summaries regarding electrical hopes and aspirations—which, in the non-technical sphere, appear to be as diverse as those in the Gas Industry—we come to another report which has just been issued immediately on the heels of the I.E.E. memorandum. This latest report gives the views of a committee representing more than 90% of the municipal and company distribution undertakings of the country and will be submitted to the Minister of Fuel and Power, at whose request the committee, representing the Incorporated Municipal Electrical Association, the Provincial Electric Supply Association, the London Electricity Supply Association, and a group of power companies who are members of the Incorporated Association of Electric Power Companies, was set up.

The present report is a parallel to that of the British Gas Federation, and many of the views expressed in it show parallelism. In common with the recommendations put forward in previous reports on electricity supply the present "industry report" recommends a standard form of tariff for domestic supplies, a standard system of supply, hastening of rural electrification, and more facilities for hire and hire-purchase of appliances. Regarding ownership and organization of existing undertakings, neither, it is stated, should be subjected to drastic

alteration unless it can be proved that consumers will derive substantial and permanent benefit thereby. Linking-up of undertakings in specified areas with the introduction of a common policy of service is suggested, as is co-ordination by area committees—the areas to be determined by the Electricity Commissioners, who should appoint paid chairmen to preside over these committees, the recommendations of which would be subject to the approval of the Commissioners or, in certain instances, of the Minister of Fuel and Power, or of Parliament. And the Electricity Commission itself should be brought up to full strength, removed from Treasury control, and made the focal point of the reorganization and future development of the electricity industry. The committees, then, are advisory only, and it is to be doubted whether advice not supplemented by statutory powers—*i.e.*, lacking compulsion—will prove adequate either for electricity or gas. Of course the idea of co-ordination is to be welcomed, but the idea in itself would seem insufficient. The memorandum does not discuss the transfer of undertakings in areas to public distribution authorities, or the union of municipal undertakings by means of joint boards.

It is, however, in the question of future competition between gas and electricity that we are most interested, and on this point the report is emphatic enough. Perhaps "dogmatic" would be a better definition. Any suggestions for regulating competition after the war between the industries supplying different forms of fuel do not find any favour—a fact which must influence Gas Industry policy. We have discussed this matter of amity or antagonism between gas and electricity many times during the war and our views have been constant. We have hoped, in the national interest, for some co-operation, though we have admitted that we have discerned few signs that the hope is justified. The report under review states there is no evidence that competition is anything but a stimulus to the fuel industries and a guarantee of progress from which the public derive increasing benefits, and that the result of co-operation, apart from causing dissatisfaction to the public, would be to stifle electrical development.

In regard to this we were interested in a leader in *The Times*, which, commenting on the report, said: "Competition certainly provides the main stimulus of technical advance in the fuel industries, and unquestionably provides the consumer with a guarantee of efficient service. But it seems scarcely compatible with the facts to suggest that competition between the fuel industries has never been socially harmful, or that rivalry in salesmanship has always protected the consumer from biased publicity or tendentious advice." And it added: "The Gas Industry, *no doubt because it is on the defensive* [our italics] has taken a lead in proposing a national policy for fuel utilization and advice to consumers. The electricity supply industry for its part cannot ignore the issue; nor can it refuse to admit that the continuation of competitive enterprise is consistent with, and indeed requires, a definition in the national interest of limits beyond which competition degenerates into waste." We ourselves feel sure that through some measure of co-operation gas and electricity could expand together, and that the consumer would get both gas and electricity at lower cost than would be possible under conditions of blind competition. Equally we are sure that the Gas Industry is not acting on the "defensive" in this matter in its own interests, and that if antagonism is to be the watchword, then the Industry must take steps now, and prepare to resume the battle of competition with vigour, resource, and determination.

ENTERPRISE

"THERE is a good deal of sheer unreality in the controversy between 'private enterprise' and 'public control' in these days when the prevailing conviction is that the prosperity and even the safety of the country depend upon preserving and encouraging the spirit of initiative and adventure, while it is recognized just as clearly that the efforts of the individual, of the independent firm, and even of the organized industry can best serve the common welfare when they pursue a common policy and fit into a common framework." This, again, is a quotation from *The Times*, and it seems to us a line of thought which we could usefully bear in mind in regard to the development of our own Industry. We need initiative and the spirit of adventure, and it can by no means be said in truth that public control holds a monopoly in the encouragement of initiative. Nor do we think that the future success of the Industry will depend on ideological discussion, on which it is easy to fritter away time and energy which could be put to better purpose in tackling immediate problems concerning the improvement of service to the consumer. For it is on efficient service to the consumer, following a policy of efficient coal utilization in the national interest, fitting into a common fuel framework, that the Industry will progress or fall back.

As we have said before, technically the Industry has made improvements in recent years, including the war years. There have been many pointers to more efficient carbonizing practice, the raising of the standard of the process generally. Research has in fact resulted in a large amount of severely practical knowledge, and it remains after the war to translate this knowledge more universally into practice, whatever the means adopted in "integration." But research on gas-making, which is an engineering-cum-chemical job, is not enough. Obviously an important part, it is still a part only, in making better service possible. What we may term "accountancy research" or "business research" is needed in our Industry, and the application of imagination to the business angle of gas service has in the past left much to be desired. We believe that the accountant can be as research minded as the scientist and technician, and that the councils within the Industry might well give thought to this aspect. It would, we suggest, be found more fruitful than sole concentration on debate on ideologies, for there is much to be done, and talk alone will effect nothing.

We are, however, rather running away from the subject of this note, which is the impressive speech of Lord McGowan to the Glasgow Chamber of Commerce last week in which he partially raised the veil on the war effort of Imperial Chemical Industries, in which, too, he showed what an essential part I.C.I. has played in the struggle. He said that the system of privatet enerprise, upon which Britain's national greatness had so largely been built, was under fire, that there was a wealth of misrepresentation designed to create the impression that existing methods of conducting industry had failed, that control by the State was the only way to usher in a new Utopia. The huge resources of I.C.I., built up by private enterprise and integration, were at the disposal of the Government both before and at the outbreak of war. And where, asked Lord McGowan, do the critics of private enterprise think the peacetime Government of a democracy keeps the army of experts that becomes necessary on the outbreak of war? And the answer he gave was that it did not keep such a force, nor could it. "The only reservoir on which the State can draw in the hour of emergency is provided by the great enterprises of the country, whose personnel and plant have of necessity to be kept up to the highest pitch of efficiency in order to secure for Britain a share in the trade of the world."

He followed up by instancing how I.C.I. had helped—and, if necessarily incomplete, it was a splendid story he had to tell—noting that in each instance I.C.I.'s ability to help rested largely, though by no means entirely, on its peacetime research—research the achievements of which provided conclusive evidence that Britain has not lost that spirit of inventiveness which has distinguished it. Nor, he emphasized, is the record peculiar to I.C.I. Similar achievements stand to the credit of other great organizations which have been built up in peacetime, integrating interdependent enterprises under a common direction. He did not for a moment suggest that private enterprise was not subject finally to Parliament, "which must always have the last word and be in a position to ensure the protection of the consumers." He looked to the Government to help industry, but insisted that this did not mean interference in the administration of industry.

Direct, vigorous, and clearly reasoned, there is much in Lord McGowan's speech on which the Gas Industry might ponder.

For it is on striving continuously for the highest efficiency—not just technical efficiency, but business, commercial, and "service" efficiency—that the Industry's development within the composite fuel field depends; and we must constantly have in mind that much-worn truism that the strength of a chain is that of its weakest link. Finally, it is good that industry should inform the public what it is doing and what it is trying to do, and this pertinently applies to the Gas Industry.

A Minister of Science?

Last week Lord Samuel, President of the Parliamentary and Scientific Committee, suggested that the Lord President of Council should exercise the functions of Minister of Science in the Cabinet. At the moment the Lord President did perform some of the functions of such a Minister, but had no properly developed Department to assist him. He did not advocate the creation of a new Ministry with a new title, but he suggested—for consideration in due course and not for immediate decision—that the President of the Privy Council should have his functions enlarged and his Department expanded, that he should be given an intelligence or information department. He should be the representative of science as such in the Cabinet and among the other Departments. Lord Samuel said that the Parliamenatry membership of the Committee had doubled in the past year and the member-associations had increased by nearly 50%. In the same time their activities had greatly increased.

The occasion of the suggestion was the annual luncheon of the Committee, and Lord Woolton, Minister of Reconstruction, advocating the application of a greater measure of science to the home and the kitchen, said that the growth of public interest in the application of scientific discovery to the affairs of everyday life was one of the most encouraging features of our times.

Personal

Mr. L. P. INGRAM, M.Sc., A.I.C., has been appointed Engineer and General Manager of the Bognor and District Gas and Electricity Company and will take up his duties in the near future. He is at present Engineer and Manager of the Borough of Loughborough Gas Department.

Obituary

The death has taken place of Mr. WILLIAM BENNETT, A.M.C.T., Engineer and General Manager of the Ashton Gas Company and the Mossley and Saddleworth Gas Company, at the age of 57. He received his early training at the Stalybridge Gas-Works, where his father was Works Superintendent, and he afterwards took charge of the carbonizing plant at the Greenock Gas-Works, and rose to be Chief Assistant Engineer and Manager. In 1917 to 1919 he was Engineer and Manager of the Lytham Gas Undertaking. He was appointed Engineer and Manager of the Mossley Corporation Gas Undertaking in 1919, and here he built a complete new works, which was sold in 1936 to the Mossley and Saddleworth Gas Company. Mr. Bennett then became Engineer and General Manager of the Ashton and the Mossley and Saddleworth Gas Companies.

Mr. G. M. Gill writes:

William Bennett was an exceptionally clever engineer and technical man, both in practice and theory. He did not spare himself, which, coupled with the extraordinary difficulties brought about by the war, probably hastened his death. He leaves behind him a monument in the shape of the Mossley Gas-Works, which must be one of the best works in the country, and which he designed and built.

* * *

We regret to announce the death of Mr. HERBERT LEES, J.P., Assoc. M.Inst.C.E., Managing Director and Secretary of the Hexham Gas Company, with which Company he was associated for over 50 years, 35 of which as Engineer. Well known throughout the Gas Industry for his active and outstanding work in many directions, Mr. Lees was one of the oldest members of The Institution of Gas Engineers. He was elected a member in 1885 and served on the Council in 1908–9, 1910–13, and 1926–28. Mr. Lees was twice President of the North of England Gas Managers' Association, in 1895 and 1926, of which he was Honorary Secretary for 19 years. He was the first to be elected an Honorary Member of the Association, whose welfare he had particularly at heart, though his help was extended over a wide sphere, including the activities of the National Gas Council and the Federation of Gas Employers.

Southern Association

Mr. F. Dawson, newly-elected Chairman, presided at a meeting of the Southern Association of Gas Engineers and Managers (Eastern District) at Gas Industry House on Feb. 4, when a hearty vote of thanks was accorded to Mr. J. M. Webber for his services as Chairman during the past year.

On the recommendation of the Committee it was agreed that future sessions should date from July 1 to June 30 instead of from Jan. 1 to Dec. 31, in order to bring the District into line with other bodies and enable the Chairman to prepare his winter programme during the summer months, the present session being extended to June 30, 1945. The decision is subject to confirmation by the parent Association next month, by which time it is hoped that the Western District will have approved of a similar change.

It was also agreed that one representative of the London and Southern District Junior Gas Association should be a member of the Eastern District Committee. The constitution of the Committee was revised so as to provide that four members should be elected each year, to serve three years, the retiring members not being eligible for re-election for at least one year afterwards, that representatives on the General Committee should be *ex-officio* members of the District Committee, and that the Chairman, Vice-Chairman, immediate past Chairman, and Secretary should also be *ex-officio* members.

Mr. A. Renfrew, Development Manager of I.C.I. (Plastics) Ltd., presented a Paper on "Properties and Uses of Plastics," a report of which will appear subsequently in the "JOURNAL."

Gas Staff Organization

In the "JOURNAL" of Feb. 24, 1943, we published a summary of a Paper by Mr. Brian Wood and Mr. G. T. Baseden on Staff Committees in the Gas Light and Coke Company. That Paper forecast the establishment in the Gas Light and Coke Company of a Central Staff Committee to co-ordinate the activities of departmental staff committees, and since that time there has been a development among the London gas undertakings generally of the organization of the staffs. Some of the companies have Staff Associations already in being, while in others the process is practically complete.

In view of these developments, the National Union of General and Municipal Workers, which represents the manual workers and has several hundred members in its Clerical Section, held a meeting at Livingstone Hall, Westminster, on Jan. 31, at which the following resolution was passed: "That this meeting fully recognizes that real representation of the gas administrative and clerical staffs can be promoted only through a trade union affiliated to the T.U.C., and urges that all necessary steps are taken to organize on this basis." The meeting was presided over by Mr. J. Walter, General Secretary of the Association of Inspectors of Taxes, and addressed by Mr. L. C. White, General Secretary of the Civil Service Clerical Association, Mr. H. Morgan, Assistant Secretary of the Bank Officers' Guild, Mr. D. Wilson, of the Railway Clerks' Association, and Mr. W. Hardy, of the National Union of General and Municipal Workers.

Here is perhaps a matter for debate—possibly controversy—but whatever may be the arguments for or against any particular form of organization, the question will be settled by the decision, freely taken, of the staffs themselves.

University of Leeds

Among the degrees conferred at Leeds University on Jan. 26 were the following:

Ph.D.—J. S. Forsyth, B.Sc.(Glasgow), former Institution of Gas Engineers Research Fellow, for a thesis entitled: "A Study of the Measurement of Ignition Velocity and Related Phenomena."

B.Sc. in Gas Engineering.—K. Donnan.

B.Sc. in Fuel and Metallurgy.—J. H. Cook.

Dividends

East Surrey.—The Directors are recommending the payment of a dividend for the half year ended Dec. 31, 1943, of 2½% on the Company's Ordinary "B" Stock, making 5% for the year. These rates are the same as those paid last year.

Newcastle and Gateshead Gas Company.—Final of £2%, less tax, on the Preference Stock, making £4% for the year, and £2 17s. 6d.%, less tax, on the Ordinary Stock, making £5 7s. 6d.% for the year.

Romford.—Final dividend for the year 1943 on the Ordinary Stock 3½% (actual), which, with the interim of 2½% paid (actual), makes 6% for the year (less tax).

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

NOTES ON THE PROPOSED BRITISH GAS ASSOCIATION

[Communicated]

A. Scope of Association

1. In considering proposals for the formation of a British Gas Association, it is first necessary to determine if the Association is to be—in the words of the "Report on the Planning of the Gas Industry" of the British Gas Federation—the "representative and authoritative body of the Gas *Supply* Industry," or if it is to be designed to represent the Gas Industry as a whole. The original intention was confined to the merger of the National Gas Council and the British Commercial Gas Association in a new national body. But it is now proposed to provide for other bodies connected with the Industry to participate in the work of the Association by becoming associate members. The result of thus endeavouring to provide an "umbrella" for all organizations is a complicated Constitution, which has not led and may never lead to such participation.

2. The Institution of Gas Engineers is precluded from becoming an associate member; the Society of British Gas Industries considers it can have no place in the functions of the British Gas Association; no change is to be made at this juncture as to the independent position of the Federation of Gas Employers; while the national associations concerned with research, coke, benzole, tar and sulphate have not intimated their intentions and are likely, for one reason or another, to be prevented from becoming associate members.

3. While, therefore, the proposed Association can claim comprehensively and effectively to represent the Gas *Supply* Industry, it cannot be said to represent the other national organizations. It follows that, if the formation of the Association is to result in the liquidation of the British Gas Federation—as is clearly visualized—the Gas Industry as a whole will be less favourably placed than hitherto in respect of having a representative body.

4. It is suggested, therefore, that the proposed Association should not endeavour to extend its scope beyond being the democratic representative of all gas undertakings and should not purport to be a federal body as well. This should occasion no uneasiness to the Gas Supply Industry, since all other sections of the Industry in fact wholly depend upon the gas undertakings. The only practical and logical alternative would be to wind up all the national gas organizations, and substitute an association with a number of divisions covering the activities of them all. But this would not be possible, and would result in the loss of certain commercial and other advantages which accrue from having distinct organizations to deal with separable parts of the gas, coke, and by-products business.

5. This limitation of the proposed Association to gas undertakings would not preclude close collaboration with other sections of the Industry. Apart from the fact that the individual members of almost all organizations are largely comprised of the representatives of gas undertakings, co-operation could be secured—not by offering associate membership of the Association to such organizations, but (i) by electing the chairman and vice-chairman (or other office holders) for the time being of each as *ex officio* and individual associate members, or by co-opting them as individual members of the Central Council, and (ii) by ensuring the adequate representation of such organizations on the Committees of the Association particularly concerned with their respective sectional interests.

6. The British Gas Federation, which has of recent months fulfilled an essential and useful role, could be continued in an enlarged form as truly representative of the Industry as a whole, the understanding being that it would only act and speak for the entire Industry as and when it was given a mandate so to do by its constituent members, the number of which could be increased to comprise all representative organizations.

7. In considering the scope of the Association, it should be remembered that its finance and management would in practice be almost entirely in the hands of gas undertakings, which is hardly likely to be acceptable to other interests. The representation of such other interests would not, in any event, extend beyond the Central Council, for they play no part as such on the District Councils, the members of which are provided exclusively by gas undertakings. This might well lead to difficulties, since considerable emphasis is placed upon the importance and scope of the work of the District Councils, which are given a substantial measure of autonomy and power to deal with all matters concerning the District, in pursuance of which they will be financed by the Association.

B. Representation and Voting

8. *Ordinary Members* (*i.e.*, every gas undertaking, however small or large) are each to be represented by two representatives on the District Council, each representative having one vote except in the unusual event of a poll being demanded, when each undertaking has from 1 to 8 votes, according to the quantity of gas sold. The District Councils elect the Central Council, the number of Central Council members from each District varying from 1 to 7 according to the total quantity of gas sold in the District, each Central Council member having one vote. At central meetings each gas undertaking may be represented by two representatives, voting being by show of hands unless a poll is demanded, when the undertaking has from 1 to 8 votes, according to the quantity of gas sold.

9. Thus proportional representation and voting is recognized under one scale on the Central Council, but not on District Councils or at general meetings unless a poll is demanded, when proportional voting is determined by another scale. This complicated and inequitable situation arises from the failure to recognize that, for all purposes, representation and voting should have "weighted" regard to the quantity of gas sold. This could be readily achieved by providing—

(*a*) for each undertaking to be represented on the District Council according to size, each representative having a vote by show of hands or on a poll;

(*b*) for District representation on the Central Council to be according to the size of the District, calculated in proportion to the total number of representatives on the District Council, each representative on the Central Council having a vote by show of hands or on a poll; and—

(*c*) for all undertakings to be represented at General Meetings by their representatives on District Councils, each representative having a vote on a show of hands or on a poll.

10. Failure to recognize throughout the principle of the "weighted" proportional representation and voting of undertakings has the following disadvantages:

(1) It is inequitable, since representation and voting should be proportionate to interest. If 15 of 1,000 gas undertakings make 15% of the total gas sold, they would be represented to the extent of only 1.5%. The smaller undertakings, having a sense of proportion, do not expect to have the same number of representatives as the larger undertakings, the excessive representation of which could be avoided by fixing a maximum representation for any individual undertaking.

(2) It does not give reasonable representation to municipal undertakings *vis-à-vis* company undertakings. 806 company undertakings supply 65% of the total gas sold, whereas 286 municipal undertakings supply 33.6% of the total gas sold. Disproportion in the representation of municipal undertakings on the British Gas Association has been recently emphasized by the Association of Municipal Corporations and the Association of Smaller Municipal Gas Undertakings in their respective reports on the Post-War Planning of the Gas Industry.

(3) It excludes from participation in the work of the Association men who could contribute much, since if they serve larger undertakings it would frequently be impossible to find places for them on their District Council, membership being limited to two members of each undertaking irrespective of size.

(4) It results in complication and confusion, and is likely to lead to friction and misunderstanding whenever voting takes place on a contentious or important matter.

11. It should be borne in mind that provision has been made for the representation and voting of *Associate Members* and *Overseas Members* on the Central Council and at general meetings. The number of representatives and the number of votes accorded them will be determined by the Council as and when each such member is admitted to the Association. It will be essential, therefore, to ensure from time to time that the representation and voting of associate members and overseas members is not disproportionate to that of ordinary members, which may necessitate either an excessively large Central Council, or restriction as to the admittance, representation, and/or voting of associate and overseas members.

C. Development Board

12. Provision has been made for the appointment of certain Standing Committees (or Boards) to control the Divisional activities of the Association as hitherto discharged by the N.G.C. and the B.C.G.A. The proposals name these committees, but do not otherwise indicate their scope or (which should be rectified) provide for committees dealing with, for example, parliamentary and legal matters or the Industrial Gas Centres. On the other hand, provision is made, separately and at length, for a Development Board (in fact a Commercial Development Board), which is to have considerable autonomy and is to be responsible for promoting the commercial prosperity of the Gas Industry, including the commercial aspects of the technical development of the use of gas in all fields, which terms of reference could, on the broadest interpretation, cover every aspect of the work of the Association.

13. It is understood that the Development Board has been specially provided for to give effect to an Agreement come to between the Executive Committee of the British Commercial Gas Association and the Central Executive Board of the National Gas Council in 1942. That such an "Agreement" has been entered into and its precise terms not disclosed must occasion surprise to gas undertakings constituting the British Commercial Gas Association and the National Gas Council. It cannot be regarded as expressing anything more than the

Why you should buy National Savings Certificates

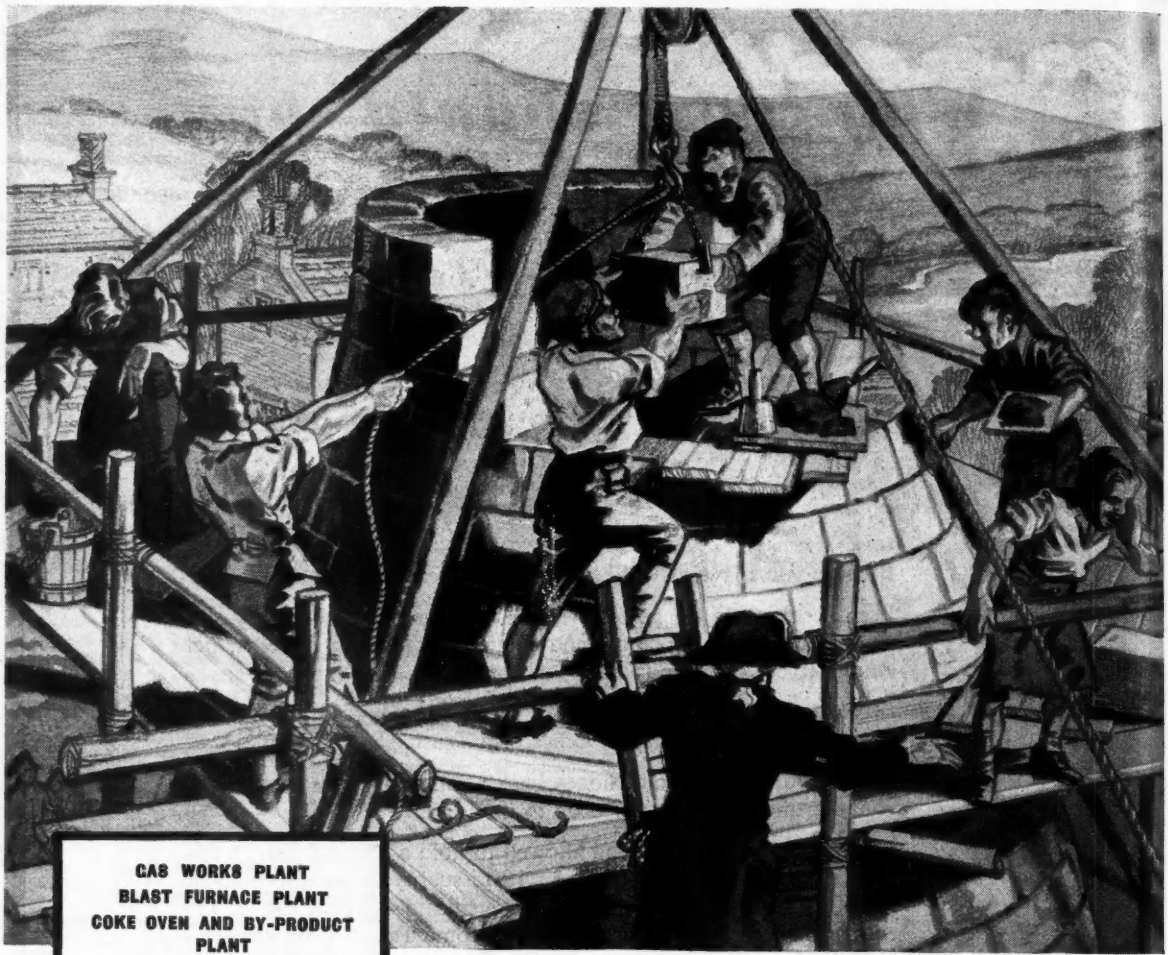
- Because your Savings will be absolutely safe.
- Because every 15/- invested becomes 20/6 at the end of 10 years: an increase equal to compound interest at £3.3.5 per cent. per annum free of Income Tax.
- Because they are easy to buy through your Savings Group or War Savings Centre, or at a Post Office or a Trustee Savings Bank.
- Because you can get your money back at any time, plus any interest your Certificates have earned up to that date.
- Because, in addition to being allowed to hold a total of 500 Certificates made up of the 15/-, 15/6 or 16/- issues, you can also hold up to 250 of the £1 issue. This latter Certificate is worth 23/- at the end of 10 years. Increase free of Income Tax. Both the 15/- issue and the £1 issue can be bought outright or acquired by instalments by purchasing 6d., 2/6d. or 5/- Savings Stamps.

NATIONAL SAVINGS CERTIFICATES

• Easy to buy • Easy to hold • Easy to cash • Absolutely safe

SPACE GIVEN BY THE WOODALL-DUCKHAM CO., EPSOM ROAD GUILDFORD. (Tel.: GUILDFORD 3301)

Issued by the National Savings Committee



GAS WORKS PLANT
BLAST FURNACE PLANT
COKE OVEN AND BY-PRODUCT PLANT
BREWERY AND DISTILLERY VESSELS
CHEMICAL PLANT
CAST IRON TANKS
MILD STEEL TANKS (Riveted or Welded)
STEELWORKS PLANT
HEAT RECOVERY PLANT
EXCAVATORS
STEEL BRIDGES
STRUCTURAL STEELWORK
GENERAL ENGINEERING

The vision and enterprise which guided George Newton and Thomas Chambers to Thorncliffe in 1793 to found the great Thorncliffe Works has been a jealously guarded heritage of the Company right to the present day.

Continuous development through the research of more than 150 years has been reflected in the Company's range of products, which is listed in the adjoining column.

NC

NEWTON CHAMBERS

NEWTON CHAMBERS & CO LTD THORNCLIFFE NR SHEFFIELD

views of the Executive Committee and the Central Executive Board and is not binding on gas undertakings, which must be left entirely free to determine—ultimately in General Meeting—upon what terms the National Gas Council and the British Commercial Gas Association shall be merged in the British Gas Association and how the new Association shall be constituted and its work conducted. In any case, such an "Agreement" is tantamount to the making of a contract with oneself, since the N.G.C. and B.C.G.A. alike and equally owe their existence to the gas undertakings.

14. It is suggested that it is unnecessary specially to provide for, and confer exceptional powers upon, a Development Board, which could appropriately be included among the Standing Committees of the Central Council. The functions of the Board would then be determined, with those of other Standing Committees, by the Central Council, there being no necessity to lay down in the constitution the terms of reference of these Standing Committees. Apart from the logic of such procedure, there are definite disadvantages in endeavouring to create a special position in the constitution itself for the Development Board, namely:

(i) It creates a division of responsibility for the conduct of the affairs of the Association between the Central Council and the Development Board, the effective control of the Central Council being limited in that the Board is accorded the following exceptional powers, among others:
  (*a*) The Board shall deal with all matters calculated to promote the commercial prosperity of the Gas Industry subject only to the control of the Central Council in matters of general or national policy or affecting the Gas Industry as a whole.
  (*b*) The Board may appoint its own manager, secretary, and staff, subject only to the approval of the Central Council and, presumably, without reference to the Establishment Committee, by which all other officers and staff of the Association would be controlled, or the Director of the Association, who is entrusted only with the general control of members of the staff of the Association. If this is not substantially the intention, then separate provision for the officers and staff of the Board becomes unnecessary.
  (*c*) The Board shall make its own arrangements for dealing with its funds, other receipts and expenditure, and shall keep its own accounts, subject only (it is conceded) to their being open to inspection by the Central Council. Presumably, therefore, the financial affairs of the Board will not be subject to the control of the Finance Committee of the Association or to the oversight of the Director of the Association. If this is not substantially the intention, then separate provision for the finance of the Board is unnecessary.

(ii) It places the Board in a position superior to and more independent than that occupied by other Standing Committees of the Central Council, which is not conducive to harmonious and co-operative working.

(iii) It deprives the Association of flexibility in its development, the rigid formulation of part of its work creating limits which cannot be readily altered to meet changing circumstances or to give effect to experience gained. The importance and extent of commercial development work and the fact that it will absorb a large part of the revenue of the Association are fully recognized. As the Planning Report said, "the British Gas Association will carry on and extend the outstanding and pioneer publicity and commercial development work hitherto done, with success and on a large and comprehensive scale, by the British Commercial Gas Association." But the conduct of such work does not require the establishment of an association within an association; it can best be entrusted to a Commercial Development Board (as for other Standing Committees) by resolution of the Central Council and extended or varied from time to time as deemed expedient.

(iv) It may result in a similar division of responsibility between District Councils and District Development Boards with the like disadvantages.

(v) It unnecessarily complicates and extends the Constitution (which should be as simple as possible at the outset), and tends to maintain that overlapping and lack of co-operation which the formation of the British Gas Association is intended to overcome, not only in Council and Committee, but in the daily, vital work of officers and staff at Gas Industry House.

D. Subscriptions

15. It has been the practice in the Gas Industry to express the size of an undertaking in terms of its make of gas in cubic feet. While there is now wisely substituted a standard of therms sold, it is suggested that even this, in present and future conditions, is not a rational basis upon which to levy subscriptions to the Association. A man is taxed on his income, not on his girth, and similarly the subscriptions of gas undertakings should be based upon revenue. But, since there is not as yet uniformity in the compilation of accounts, it is submitted that, for subscription purposes, revenue should mean the net revenue from the sale of gas, as shown in the accounts of the undertaking for its last financial year.

16. By so doing an undertaking in a position to provide cheap gas, or supply large quantities at low rates to industrial consumers, would not be prejudiced. Further, the complication of excluding gas sold in bulk from liability to subscription would be avoided, since the revenue basis would equitably disregard the sources to which gas is sold. In considering this matter it has to be borne in mind that cheap industrial gas will become an increasingly heavy load to more and more undertakings, while integration may result in certain undertakings supplying increasingly large quantities of gas in bulk. Another advantage of the revenue basis is that it is readily and precisely ascertainable from the accounts of the undertaking, whereas therms sold necessitate individual declaration after adjustment.

17. It is submitted that the regulations, while fixing the basis upon which subscriptions would be levied, should not state the actual amount. Sufficient indication of this, on a pre-war basis, can otherwise be given, but there it should be left, since the post-war revenue must inevitably be substantially higher to meet the rise in costs, and the considerably extended work to be undertaken by the new Association and the Districts.

E. Miscellaneous

18. Among other matters requiring consideration may be mentioned the following, which are expressed in the form of suggestions:

(i) That the first *Object* of the Association should be "to promote the provision by the Gas Industry of the utmost efficiency and economy in its service to the community."

(ii) That further consideration should be given to the allocation of all *research and technical work and education* as between the British Gas Association, The Institution of Gas Engineers, and the Gas Research Board. The Institution and the Research Board are well qualified, equipped and experienced to carry out all research and technical work for the Industry, while in educational matters the Institution has an organization, prestige and record of which the greatest use should be made. The conduct by the Association of research, technical and educational work would lead to overlapping and wastefulness. Co-operation to ensure that the commercial aspects of such work are not overlooked could be secured by the representation of the Association on research, technical and educational Committees of the Institution and the Research Board.

(iii) That the place of the Industrial Gas Centres in the future organization of the Industry should be determined forthwith. Although largely commercial, the activities of these Centres are only truly effective if based and developed on sound technical grounds. It would appear that The Institution of Gas Engineers should be responsible for the Industrial Gas Centres, subject to adequate representation being accorded the British Gas Association, and that such responsibility should be extended to the *Area Technical Development Centres*, if and when such are set up in accordance with the recommendations of the Planning Report.

(iv) That the Women's Gas Council (or "Home Service") should be accorded a definite place in the British Gas Association. Women are the principal customers of the Gas Industry, and their views demand adequate facilities for direct expression.

(v) That detailed consideration should be given forthwith to the uniform and co-ordinated organization of the *Districts*. Since they are to be an integral and vital part of the British Gas Association, complication, wastefulness and overlapping will result if they are not organized—with due regard to local circumstances—on a common basis. Thus, there should be uniformity in title, authority, scope, membership, finance, and the functions of their Committees. It would, for example, be confusing and unworkable if their financial years terminated at different times, or if their annual general meetings were not held and their reports to the Association not rendered by a given date.

(vi) That the Central Council should be empowered to make "*Standing Orders*" designed to amplify the Regulations, but to be entirely consistent with them and subject to cancellation or modification if the members in general meeting so resolve. Such Standing Orders would be published from time to time, with the regulations for the guidance of all concerned.

(vii) That the Regulations should require the Association to take over the assets and liabilities of the N.G.C. and B.C.G.A., and assume their rights and responsibilities.

(viii) That the principal *Officers* of the national organizations concerned with the proposed British Gas Association should be requested jointly to submit their observations on the proposals for the information of the British Gas Federation. Such observations would be of value, since the officers have for long been vitally concerned in the practical carrying out of such work as that to be discharged by the Association.

F. Conclusion

19. These notes are not directed towards the furtherance of any sectional interest of the Gas Industry. Neither are they intended to be critical of the excellent work done, in the light of insufficient information and under difficulties, by those responsible for the ably prepared proposals now before the Industry. The immediate formation of the

(*Concluded on p.* 189)

LIQUID FUELS AND ORGANIC CHEMICALS FROM COAL AND HOME REFINED PETROLEUM*

By HAROLD MOORE, M.Sc., F.Inst.Pet.

(*Continued from p. 155*)

If larger quantities of coal are to be carbonized, it would be necessary to overhaul or replace much of the tar distillery equipment at present installed in this country. One has only to visit tar distilleries to realize that they have made little technical progress during the last 20 years, and that they are very much behind petroleum practice in their technology; whereas small tube stills have only recently come into tar-refining practice, petroleum units frequently contain several stages of distillation combined with other processes, such as multi-coil thermal or catalytic cracking, all within the same circuit. Instrumentation with automatic control has been much further developed in petroleum practice, while the fuel efficiency and size of unit is greatly superior to the corresponding coal tar equipment. This state of affairs has undoubtedly been brought about by the relatively small quantities of raw material available to the tar refiner, and by the comparative poverty of the industry handicapping research.

Coal tar is a more difficult substance to work; but such difficulties as corrosion and coking of tubes should be overcome by study. The writer suspects that though petroleum is less corrosive than coal tar, the former industry spends many times more on researches on the corrosion of equipment.

At the present stage of technical knowledge it is doubtful whether much advantage could be gained by subjecting many gas-works or coke oven tars or their distillates to the cracking process. The high temperature tars are scarcely amenable to treatment, while low temperature tars become more fully aromatized. Such a process might, however, be of interest for the treatment of special low temperature tar fractions, and perhaps some continuous vertical retort tar distillates. The reduction in the proportion of horizontal retorts used in gas-works and the increasing number of continuous vertical retorts has resulted in a quality of coal tar relatively rich in paraffin and olefines, and consequently it is more difficult to prepare aromatic compounds, such as benzene, toluene, and xylenes, from this material. By utilizing aromatization plant (hitherto developed by the petroleum industry) the paraffins and olefines can be almost completely converted into aromatics, thereby increasing both the yield and purity of these products.

It is difficult to estimate how much extra coal would be carbonized as a result of a political drive on the lines suggested; naturally, the change would be gradual, but we might expect that the total quantity of coal carbonized might be increased from the pre-war figure of some 40 million tons to something in the region of 60 million tons, with an increase of spirit and coal tar production of over 1 million tons. The bulk of the extra liquid products would be consumed on the fuel market.

The Hydrogenation Process

Hitherto this process has only been workable when supported by very high subsidies. If it were certain that the pre-war price structure would remain unchanged, the writer considers that, as the products of the hydrogenation of coal are so much more expensive than the world price of petroleum derivatives, there would be little object in continuing this work. There is, however, no certainty that in the future oil prices will remain relatively low. Production and refining costs may not increase, but there is considerable doubt whether new oilfields will continue to be discovered at a sufficient rate to meet the present large requirements and the increasing demands of the future. In view of these considerations, it would be wise to continue research in this field, and as research is only possible in a process of this description when a large unit is operating, there are good reasons for continuing some form of Government support, so that one or two units would remain in operation. The Author does not consider that a scheme for producing any large proportion of our liquid fuel requirements by this process is warranted on economic grounds at present. The subsidies involved would be so costly as adversely to affect other industries. The Fischer Tropsch process is in a similar position. Research and experiment, if necessary large scale experiments, are warranted, and should be supported by the nation. A small plant operating on the process would supply certain special products which possess limited markets, and, therefore, might be more economic than a larger unit.

As the Government is called upon to finance these experiments by subsidy, it appears reasonable that the results of the researches should belong to the Government.

Other forms of research on finding substitutes for liquid fuels are at present being carried out, and will, it is assumed, continue in the future. Such lines are the use of gas producers on road vehicles and the use of liquid methane as fuel, development on steam-propelled vehicles, and the use of colloidal fuel (powdered coal and oil mixtures) for external combustion.

* From a Paper to the Institute of Fuel, Feb. 1.

Petroleum Refining

It is apparent that in our post-war economy we shall have to give every advantage to our indigenous supplies of raw material and import a minimum of liquid fuels, but care must be taken not to exaggerate the possibilities of coal, and think that coal products can be used as a complete substitute for petroleum, for if we make this mistake we shall so handicap ourselves that we shall destroy our organic chemical industry, and place our plastics industry in such a disadvantageous position that it will not be possible for it to meet world competition; at the same time we shall prevent our chemists from entering many new fields of activity, the possibilities of which we may not be able to foresee at the present.

Though the world production of coal (1,190 million tons, 1938) is much greater than that of petroleum (271 million toms, 1938), one must bear in mind that whereas petroleum is practically 100% hydrocarbon, coal only yields a small proportion of bodies readily suitable for further synthesis, such as the hydrocarbons and carbon-hydrogen-oxygen compounds. The mining of coal involves more effort than the mining of oil; prices are in many ways misleading, as the Government and private royalties, export taxes, concession valuations, and profits are high in the oil industry; therefore, selling price is not a reliable measure of cost of production. Also, most oil prices contain heavy items of transport and taxation, which often give an entirely false impression. At the outbreak of war American crudes cost from 20s. to 40s. per ton at the well head, and this price was only maintained by proration (legally enforced limitation of production). To-day's dollar prices are little altered, but the prices in sterling are somewhat higher, due to alteration in the exchange rate.

It will be seen that petroleum is a very much more readily available source of hydrocarbons than coal. In order to produce one ton of coal tar it is necessary to mine from 10 to 20 tons of coal, the process involving sinking shafts, strenuous underground work, and expensive handling. The 10 or more tons have then to be carbonized—a process involving much labour and equipment. The resulting ton of tar contains about half its weight of relatively low value pitch. On the other hand, petroleum is produced by drilling a relatively small hole, the capital cost is low, the labour involved small, and the process of carbonization unnecessary. The oil, though very variable, usually yields some 75% of distillate, and any residual asphalt is much more valuable than coal-tar pitch. It is obvious that the petroleum industry starts with enormous advantages, and competition from coal tar is only possible if the latter body is regarded as a by-product, the cost of its production being mainly borne by the gas and coke.

The synthetic organic chemical industry has largely been built upon the basis of the coal-tar products, particularly the bodies which are easily separated in a pure form—benzene, toluene, the xylenes, naphthalene, anthracene, phenol, the cresols, and pyridine. These have been the starting-point for the preparation of dyestuffs, explosives, pharmaceutical products, photographic chemicals, plastics, &c. Under peacetime conditions the demand for the fine chemicals might reasonably be expected to undergo a regular increase, while the plastics industry may be expected to grow at a much more rapid rate on account of the nature of the market for plastics. There exists, however, a large field of organic chemicals which cannot be economically made from coal tar. These compounds, the aliphatic bodies, require some other starting-point, and have hitherto largely relied on the fermentation industries for their raw materials.

Recently it has been found that the petroleum industry provides an excellent starting-point for the preparation of many organic compounds. The petroleum gases, by-products from the refining industry, meet most of the requirements—plentiful supply, low cost, great purity, and the necessary chemical reactivity.

The petroleum chemical industry is dependent on the refinery gases, and as the latter cannot be economically transported, this means that the resulting chemical industry can only exist alongside the refineries. As this development of the oil business promises to be of vital interest to the nation, it is necessary to assess the possibilities and economies of introducing refining into this country.

The pre-war U.K. consumption of petroleum products was 11.7 million tons. Most of this was imported in the form of finished products, but a quantity of 2.2 million tons was distilled in this country in 1939. Actually the quantity distilled here should not be taken as representative of general petroleum refining, as about half of the crude worked in this country is asphaltic oil which undergoes the comparatively simple process of distillation to an asphalt residue. This class of refining has for many years been carried out on our side of the Atlantic, as there are very obvious economic advantages already mentioned. A proportion of crude, probably about half, is, however, subjected to proper refining in this country, but this is a very small part of the total imports, representing only about 10%.

The refinery gases are products of the cracking process, and in a normal refinery, making the quota of motor spirit required for this

country, approximately 50% of the total refinery throughout would be subjected to cracking.

The yield of gas from cracking plants varies very considerably, a minimum figure being in the region of 10% by weight, while high temperature aromatization yields approximately 50% by weight. Normal established practice gives about 15% when working to liquid residue, 27% when working to coke, and about 21½% when reforming naphthas for the raising of anti-knock qualities. The catalytic processes yield somewhat less gas, and an average figure for all forms of cracking would be in the region of 20% on the input of the process, or about 10% on the refinery throughput. On a refinery capacity of 10 million tons this would mean 1,000,000 tons of gas. This gas contains approximately 50% by weight of C_3 and C_4 hydrocarbons and about 5% by weight of ethylene. With efficient recovery one might expect a sufficient quantity of propane and butane to cover the demands for bottle gas (at present only about 4,000 tons, but increasing), and a yield of over 300,000 tons of C_3 and C_4 fractions, of which nearly half would be in the unsaturated state (olefines). Such a quantity would be in excess of any immediate requirements of the organic chemical industry, but any surplus would be used for the manufacture of aviation spirit, which is made from these gases by polymerization or alkylation. The cracking processes are flexible, and generally the quantity of gas made can be adjusted over fairly wide ranges.

To create a home refining industry purely with a view to producing some 10% of gases would, of course, be letting the tail wag the dog, but there are numerous other grounds for creating a refining industry in this country. These reasons have been adequately considered elsewhere.

Refining in this country is economically sound providing full use is made of the refinery by-products. The main advantages are:

(1) It is cheaper to transport crude than a large variety of finished products.

(2) The local market requirements are best met by local refining.

(3) The refinery at consumption centre is in a more stable position, in that it is not likely that the consumer population will migrate from the district, but a refinery on a production field may easily become redundant, due to exhaustion of the wells.

(4) A refinery at consuming centre can buy its oil from any source wherever flush production occurs, and can select the quality of oil most suited for the market. The modern refinery is extremely flexible, and therefore not tied down to using any particular crude.

The advantage of establishing an industry here is beyond question, though there are certain difficulties to be met by the refiner in this country.

Many of the products which can be made in quantity from petroleum do not affect existing markets, as they are new bodies which have hitherto not been available in quantity. The coal tar industry has little to fear, as the petroleum products are mainly complementary and not substitutes for the coal-derived bodies; for example, Buna-S, the most important rubber substitute, is made from petroleum-derived butadiene and polymerized with styrene, the latter ingredient being usually made from coal-tar benzene.

Taxation

The present position is that petrol and diesel fuel, either imported or home refined from imported material, if used on road vehicles, pay a tax of 9d. per gallon, while similar heavy oil used both as fuel and lubricant pay a tax of 1d. per gallon. Home-produced oils from coal, shale, or indigenous petroleum are tax exempt, and therefore receive a virtual preference of 9d. on road vehicle fuels and 1d. per gallon on heavy oils and lubricants, while there is no distinction made between home-refined oils from imported crude and products imported in the finished state. These duties are very heavy, amounting to about 200% on the value of the road vehicle fuels.

Gas-works can strip benzole from gas and thereby obtain benzole which, being tax free, sells at a relatively high net price. The effect of removing the benzole is to reduce the quality of the gas. The gas can now be enriched by cracking gas oil (tax 1d. per gall.) and using the resulting petrol and oil gas to re-enrich the stripped coal gas. The net effect is replacing benzole with petrol and gaining the advantage of the tax difference. The operation would not be commercially feasible if it were not for the tax advantage. When road fuels and lubricants can both be made from indigenous material, the present taxation gives an incentive to make road fuels (tax advantage 9d.) instead of lubricants (tax advantage 1d.), but the latter are the more valuable products, being of higher value on the world market and probably of greater national importance. Valuable indigenous lubricants can be cracked down to low value petrol and a profit made due to the incidence of taxation.

The Author considers that in any future scheme of taxation Revenue taxation should be kept separate from tariff preferences, and the preferences should be made more equal as between the light and heavy products, also they should have some relationship to the value of the product. Particular support should be given to the relatively valuable and expensive lubricants and waxes, while a distinction should be made between imported finished products and home-refined products made from imported crude.

There are revenue reasons why the tax on motor fuels should be high, but the warping of the economic programme and the carrying out of special operations purely for tax evasion is largely brought about by the great differential between the high tax on road fuels and the relatively low tax on heavy oils. Raising of the heavy oil tax with preference to indigenous oils would facilitate the sale of excess coal tar pitch and creosote.

Conclusion

The Author considers it essential that the post-war period should see the adoption of some definite plan. He considers that the most important points in this plan are the extension of the carbonization industry and the development of the home refining of petroleum. He considers that it can be proved at the present time that a home refining industry will be of great national advantage, but believes that the development of synthetic processes based on petroleum opens up almost unlimited new fields and, consequently, the adoption of home refining is much more important than is at present apparent. At the risk of adverse criticism he ventures to put forward the following headings as the principal requirements of post-war policy:

1. Legislation against the burning of raw bituminous coal with a view to increasing the amount of coal carbonized.

2. Some form of preferential duty in favour of petroleum products refined in this country from imported crude. The incidence of this preference to be such that the raw materials required for the chemical industry would be tax-free.

3. Creation of a national organization on the lines of the existing Petroleum Board to distribute liquid fuels, solvents, lubricants, waxes, &c., made from coal, shale, and petroleum. This body to be under Government supervision, and to be controlled by representatives of the producers and the consumers.

4. The drafting of a plan to cover the refining requirements of the country and the licensing of refineries to be built on suitable sites, which should be—

(*a*) Near the centres of consumption.
(*b*) Near gas-works which would take surplus gas.
(*c*) Capable of extension and capable of providing accommodation for subsidiary chemical industry.

5. Facilitate any legislation necessary for installing pipelines.

6. Revise preferential taxation, reducing the large difference between the preference on road fuels and on the other petroleum and coal tar products.

7. Support State schemes for research, assist research by private individuals, and increase obsolence allowances for plant so that old plant may be written off and industry kept up to date.

The writer hopes that legislation along these lines should have the ultimate effect of increasing the quantity of coal carbonized in this country by at least 20 million tons per annum, while building up a large new petroleum refining industry. It should increase the efficiency of distribution of products from both the coal tar and petroleum industries, and should ensure that the industries are modernized and are maintained at a high state of technical efficiency.

It would produce a large amount of work, mainly in the installation of new equipment, during the immediate post-war years, and a considerable amount of employment permanently thereafter. The engineering trade would benefit greatly.

It should also decrease very considerably the adverse trade balance which is brought about by the importation of finished petroleum products—the latter a point of particular importance, as it may be anticipated that in the future, due to technical development, the value of products made from petroleum will be much greater than it has been in the past.

The Next Meeting of the Fuel Luncheon Club will take place at the Connaught Rooms, Kingsway, W.C. 2, on Feb. 18, at 12.40 for 1.10 p.m., when the after-luncheon Address will be given by Mr. J. G. Bennett, Director of B.C.U.R.A., the title of this Address being "Has Solid Fuel a Future for Small Scale Use?"

The Liverpool Gas Company is holding a special series of demonstrations at Radiant House, in co-operation with the Association of Hospital Matrons (Liverpool and Cheshire Groups). Special reference is being made at the six demonstrations to the use of dried egg powder, and the series will show different dishes each day in which dried egg can be used. Invalid cookery will also play a major part in the demonstrations.

Members of The Institution of Gas Engineers are invited to attend the Sessional Meeting of the Illuminating Engineering Society to be held on Monday, Feb. 14, at the Royal Institution, Albemarle Street, London, W. 1, at 5 p.m., when an Address on Some 18th Century Contributions to Photometry and Illuminating Engineering will be given by the President (Dr. H. Buckley). Cards of admission may be obtained from the Honorary Secretary of the Illuminating Engineering Society, 32, Victoria Street, S.W. 1.

FUEL AND METALLURGICAL FURNACES*

By R. WHITFIELD, M.I.S.I., M.Inst.Met.

IT is remarkable that practically everything we use has been subjected to heat treatment of some kind, and most articles of commercial use have been subjected to many applications of heat. One of the main factors involved in heat treatment, or in metallurgy, is the efficient utilization of fuel without damaging the quality of the product. The main object of a furnace is to produce efficiently heat-treated materials. Incorrect fuel control, heating to the wrong temperature, or in an unsatisfactory atmosphere may seriously impair the quality of the finished product or result in excessive waste. For this reason temperature and atmosphere require very careful consideration. Yet exact calculations are practically impossible. The large number of factors, especially when calculations relating to heat transfer by convection, radiation, or conduction are involved, make the mathematics somewhat difficult. For instance, considerable difference is caused by a change in the nature of the surface of the material, even though the material itself may remain the same.

Although there are certain well-defined exceptions, high temperatures in the heating of steel are usually deleterious for the following reasons:

(1) Quenching from temperatures above the necessary minimum affords no increase in hardness.

(2) The crystal grain size increases with increasing temperatures; large crystalline grains mean brittleness and other faults.

(3) The steel is insufficiently "soaked" to give equality of temperature throughout the mass.

(4) It is difficult to roll unevenly heated steel to accurate and uniform sections, and the power consumption for rolling is increased.

(5) The higher the temperature the greater the tendency to an oxidizing atmosphere with consequent excessive scaling.

(6) Maintenance cost is increased, also the loss of production owing to the furnace being laid off for repairs more frequently.

(7) The fuel consumption is greatly increased.

The advantage to be gained by increasing furnace temperatures is that the rate of heat transfer is increased, thus reducing the time during which the stock must be heated, and therefore enabling a furnace of given size to increase its throughput. This is undoubtedly of considerable value, especially at the present time, but when this is done there is always the risk that the faults mentioned above may arise.

The effect of the large crystalline grains produced by high temperature treatment is well shown by the following example of a 0.4% carbon steel for which the correct treatment is 810° to 860°C.

TABLE I.

Treatment A—heating to 1,000°C.
" B—heating to 820°C.
" C—heating to 820°C. with prolonged soaking.

Treatment.	A.	B.	C.
Ultimate strength, tons/sq.in. ...	47	41	27
Elastic limit, tons/sq.in.	26	22.5	13
Elongation per cent. on 2 in. ...	7	23	40
Reduction in area per cent. ...	3	37	64

It will be seen that heat treatment at 1,000°C. produced an extremely brittle steel with very little elongation or reduction in area, a steel which has practically no commercial use. Forging temperatures are, of course, much higher, and would result in very large grain size if the forging process itself did not break up the grains under the press or hammer.

The serious effect of high furnace temperatures on fuel economy can best be shown by a definite illustration. It is assumed that the heat treatment operation is the annealing of 0.4% carbon steel at a minimum essential temperature of 800° to 850°C., and that this is being done in a furnace whose internal dimensions are 6 ft. by 4 ft. by 2 ft. The internal superficial area of the furnace will be 88 sq.ft., and from experience it can be safely reckoned that a heat input of 6,000 B.Th.U. per sq.ft. of surface per hour is necessary to maintain an empty furnace temperature of 900°C. If we take it that the intensity of radiation in the furnace varies as the fourth power of the absolute temperature, the following table may be constructed:

TABLE II.

Furnace temperature, °C.	900	1,000	1,100
Heat input, B.Th.U./sq.ft./hr. ...	6,000	8,300	11,200

An increase of 200°C. in the furnace temperature thus requires nearly double the heat input. As the internal surface is 88 sq.ft. the total extra heat input will be 88 (11,200—6,000)=457,600 B.Th.U. per hour. This is, of course, a very rough estimation, but it shows that keeping the furnace fully occupied is necessary to economical working.

The external heat loss through the furnace walls is also increased. If the furnace walls consist of 4½-in. firebrick and 4½-in. insulation, the heat loss per hour per sq.ft. of external surface for an interior temperature of 900°C. may be taken to be about 490 B.Th.U., rising to 620 B.Th.U. for an interior temperature of 1,100°C. The external superficial area for a furnace of the size already given, having walls 9 in. thick, will be 173.5 sq.ft. (nearly double the internal surface), so that the increased heat loss will be 173.5 by (620—490)2=2,600 B.Th.U. per hour.

These figures are based on the heat loss from vertical walls in still air; in fact, the heat loss from the roof will be about 25% greater, while that through the foundations will be about one-third less, so that for practical purposes, the overall result will not be greatly affected.

Another effect of high furnace temperatures which is frequently overlooked is the heat loss through radiation when the doors are open. The furnace interior gives practically black-body radiation through an open door, and this would be 36,000 B.Th.U. per sq.ft. per hour at 900°C., or 61,200 B.Th.U. per sq.ft. per hour at 1,100°C. The heat loss in practice can be taken to be 75% of this figure, so that the effective increase in heat loss for the 200°C. temperature rise may be taken, for the purpose of a rough approximation, to be 18,900 B.Th.U. per sq.ft. per hour. If the furnace door is 4 ft. by 1 ft. 6 in., and is open for five minutes three times each hour, the extra heat loss may be 28,350 B.Th.U. per hour.

A very practical method of reducing this source of heat loss is to cover the door opening with chains. Depending on the type of chain (its closeness, &c.), these losses may be reduced to 50 to 60% of those from an open door. With this arrangement the interior of the furnace is still visible, and, more important still, the operator can use shorter tongs. In some cases the chains may be cooled by a trickle of water.

Furnace Pressure Control

Before dealing with the very important question of furnace atmosphere, some attention must be given to the effect of furnace pressures, since if this is not controlled it will be impossible to maintain the desired atmosphere.

In most metallurgical furnaces the pressure is controlled by the chimney damper, and this is probably the most abused form of furnace control. Many a furnace which has been operating indifferently has been completely satisfactory when the damper has been adjusted and brought into efficient use. A useful and delicate indication of furnace pressure may be obtained by observing the flame from a burning wisp of paper held in front of a sight-hole in the door. Taking extreme cases by way of example:

(1) Chimney damper closed: The furnace gases have no outlet except through chinks in the furnace structure. The flame from the burning paper is blown out vigorously, indicating a considerable pressure within the furnace chamber. This is an extremely wasteful state, and also a very uncomfortable one for men working in front of the furnace.

(2) Chimney damper fully open: The test flame will be drawn sharply into the furnace, this indicating a furnace pressure less than atmospheric. This means that air is also being drawn into the furnace through every hole and chink, thus creating an uncontrolled oxidizing atmosphere. It is also extremely wasteful, since additional heat is needed to raise this excess air to furnace temperature, and this may be reduced below that desired.

The chimney damper should be adjusted to give a very nearly balanced furnace pressure (perhaps slightly positive), which will be shown by the test flame wavering. This maintains the desired furnace atmosphere, with no cold air entering or hot gases escaping.

This is probably the right place to introduce a doubt as to the wisdom of judging the economics of heat treatments by flue gas analyses, especially on tall furnaces where there is almost certain to be suction somewhere, with sufficient air being drawn in to upset the reliability of any analysis. It is, in general, practically impossible to seal a furnace completely, and it is amazing how much air will flow through a small orifice even under slight suction.

If a furnace door 36 in. wide does not come down completely so that there is a ¼-in. slot left (and this is quite common), the total orifice area is 9 sq.in. The air velocity for a suction of 0.1 in. W.G. is approximately 45 ft. per sec. If the "vena contracta" be taken as 0.75, the inflow of cold air will be 2.12 cu.ft. per sec. This is a possibility on a new furnace, and when repairs are neglected on an old one the total air flow may be extremely heavy.

If the positive pressure within the furnace is of the same order, an equivalent volume of very hot products of combustion may be ejected, constituting a considerable loss as well as creating uncomfortable working conditions.

Furnace Atmospheres

This is an important subject, and one that is not generally understood. Considerable attention has been paid to it during recent years, especially in the U.S.A., with the result that many surprising points have come to light, and some difficulties have been partially explained. It has been proved to have almost bewildering possibilities.

* From a Paper to the Institute of Fuel.

The object of a boiler furnace is to raise as much steam as possible from the fuel, and the main indicator in the combustion system is CO_2; further, the furnace atmosphere at high temperature is in contact with metal tubes containing water, and in consequence is at a relatively low temperature which is not very variable. In metallurgical furnaces the temperature of combustion is, in general, controlled by that desired in the product, and the composition of the furnace atmosphere has a very important bearing on the quality of the product. It is therefore desirable to be able to control the atmosphere without departing from the correct temperature.

The importance of the furnace atmosphere, particularly in the heat treatment of steels, has so grown that it is now a common practice to produce and maintain special atmospheres—truly neutral atmospheres which surround the work and are distinct from products of combustion. It is only proposed to deal with the natural atmospheres obtained with normal fuels, and to give an approximate idea of the influence on the metal treated, with special reference to steel.

The following table is helpful when heating steel:

TABLE III.—Effect of Furnace Gases on Iron and Steel.

Gas.	Action.
CO	Reducing to Fe(O).
CO_2	Oxidizing to Fe.
H_2	Reducing to Fe(O).
H_2O	Oxidizing to Fe.
O_2	Do.
N_2 (dry)	Neutral to Fe.
CH_4	Reducing to Fe(O).
CO	Carburizing to steel.
CO_2	Decarburizing to steel.
H_2 (wet)	Do.
N_2 (wet)	Do.
O_2 (wet)	Do.
CH_4	Carburizing to steel.

It is obvious that furnace atmospheres may vary. The variations are complicated by the fact that as the temperature rises the composition may be changed owing to—

(1) Temperature change.

(2) A change in the relative proportions of the different gases, and therefore in the partial pressures, and in the influence of mass action.

(3) Most of the combustion reactions are reversible, and are influenced by (*a*) temperature, (*b*) mass action, (*c*) partial pressures.

(4) The influence of the material which is being heated, such as: (*a*) metals, (*b*) refractories, (*c*) catalysts.

It is the complications introduced by these factors which has encouraged the use of conditioned neutral atmospheres that can be easily produced, maintained, and controlled. This involves a separation of products of combustion from the conditioned atmosphere and the metal being heated.

We can generalize natural atmospheres in contact with steel into four groups:

(1) Reducing and carburizing.
(2) Reducing and decarburizing.
(3) Oxidizing and carburizing.
(4) Oxidizing and decarburizing.

From this we can derive the fact that naturally neutral atmospheres do not exist. This is why bright heat treatment is impossible in such atmospheres. With care, a "scale free" product can be produced; this means a slight surface discoloration, which is the beginning of scale, but having no appreciable thickness. Furnaces are often blamed for scale that is created when the hot metal is in contact with air between the time it is discharged from the furnace and the time it reaches the quenching medium; it is, in fact, possible to see the scale forming.

By the use of controlled neutral atmospheres it is practical and possible to heat-treat mirror-bright material up to 1,000°C. and over, and for it to be discharged from the furnace in the same condition. To accomplish this fully, the cooling of the material must be controlled and be in constant contact with the neutral atmosphere from the moment it enters the furnace until it is cooled to atmospheric temperature, and therefore below any scaling temperature.

A few of the artificially produced atmospheres are:

(1) Charcoal gas.
(2) Cracked ammonia.
(3) Controlled (partial) combustion.
(4) Raw gas, producer gas or town gas.
(5) Cracked raw gas.
(6) Gas passed over iron borings which are kept at a high temperature by some external means of heating.

Practically all these involve the use of a condenser to reduce the water vapour content to a minimum.

By this means two principal reactions are avoided:

(1) Between iron and oxygen. (This involves scale being produced and/or reduced.)
(2) Between carbon in the steel and carbon combining gases—*i.e.*, carburization or decarburization.

These reactions can take place independently or together.

Now let us consider the so-called "reducing atmosphere." It is a fallacy to consider that clean steel is excellent in quality; and it is very important to realize that any reducing atmosphere produced by incomplete combustion is generally decarburizing, and therefore detrimental to high-carbon steels. It produces soft spots on the surface which cannot be corrected with natural atmospheres. Taking all into consideration, a slightly oxidizing atmosphere is much better; although a "scale free" product is also required. Therefore, where oxidation and decarburization must be avoided, a controlled atmosphere is essential.

In general, a reducing atmosphere is preferable for low-carbon steels because decarburization is slow and is not so serious in its intensity.

For high-carbon steels an oxidizing atmosphere is preferable, because the decarburized layer is scaled away.

As indicated above, the chemistry of furnace atmospheres is very involved. A number of reactions occur varying in intensity and effect. There are reactions between the gases themselves and between the gases and the material. The reactions may also be local or general. The speed and severity of these reactions are influenced by: (1) Fuel, (2) external humidity, (3) barometric pressure, (4) gas temperature, (5) furnace temperature, (6) temperature of material, (7) carbon content of steel, (8) type of furnace, (9) condition of furnace, (10) position of chimney damper, (11) position of flues, (12) surface condition of steel, (13) surface area of metal exposed.

The table, "Effects of Furnace Gases on Steel," given above shows individual reactions, and the following amplifies them:

Reaction Equations for Various Gases with Steel.

Reaction.	Gives.
$O_2+2Fe \rightleftharpoons 2FeO$	Oxidation.
$2O_2+3Fe \rightleftharpoons Fe_3O_4$	,,
$3O_2+4Fe \rightleftharpoons 2Fe_2O_3$	,,
$H_2+FeO \rightleftharpoons Fe+H_2O$	,,
$3H_2+Fe_2O_3 \rightleftharpoons 2Fe+3H_2O$	,,
$4H_2+Fe_3O_4 \rightleftharpoons 3Fe+4H_2O$	,,
$2CO+3Fe \rightleftharpoons Fe_3C+CO_2$	Carburization.
$2H_2+Fe_3C \rightleftharpoons 3Fe+CH_4$	,,
$CO_2+Fe \rightleftharpoons FeO+CO$	Oxidation.
$4H_2O+Fe_3C \rightleftharpoons Fe_3O_4+CH_4$	Carburization and oxidation.
$O_2+2Fe_3C \rightleftharpoons 6Fe+2CO$	Carburization.

Let us consider the combustion of a particular but typical normal town gas with the following percentage composition:

TABLE IV.

Gas.	Symbol.	% by vol.	Products.
Methane	CH_4	27.0	CO_2 and H_2O
Hydrogen	H_2	48.0	H_2O
Carbon monoxide	CO	10.5	CO_2
Carbon dioxide	CO_2	0.5	Unchanged
Hydrocarbons	C_nH_m	3.0	CO_2 and H_2O
Nitrogen	N_2	11.0	Unchanged
Total		100.0	

If excess air is used oxygen is present, and if town gas is in excess carbon monoxide is present. Generalizing, we can say that completely burnt town gas is oxidizing and decarburizing.

The analysis of the above gas burnt completely, by volume, is as follows:

	%
CO_2	8.25
H_2O	20.20
N_2	71.55
	100.00

As the gases cool down and the water vapour is condensed we obtain:

CO_2	10.5% approx. by vol.
N_2	89.5% ,, ,,

It is illuminating to study the composition with different proportions of air. Some are given in the following table:

TABLE V.—Products of Combustion with Varying Ratios Air/Gas.

Air/gas.	Ratio.	CH_4.	H_2.	CO.	CO_2.	C_nH_m.	N_2.	H_2O.
0	0	27	48	10.5	0.5	3.0	11.0	0
1	0.22	16.0	21.0	6.2	4.0	1.5	46.0	13.2
2	0.44	5.3	11.0	5.6	6.1	0.7	58.0	17.0
3	0.67	3.2	6.0	3.2	7.5	0.3	65.0	18.4
4	0.89	0.65	2.0	1.06	8.2	0.1	70.0	19.5
4.5	1.0	—	—	—	8.25	—	71.6	20.2

Some interesting facts can be derived from this table. There is a rapid increase in the water vapour present, and since about 4.5 vols. of air to 1 of gas is necessary for complete combustion, the precentage of 20 in the products means that this percentage is more than the original volume of gas. There are also rapid increases in N_2 as the air/gas ratio is increased; CO_2 increases, but at a much slower rate.

To neutralize oxidizing and decarburizing actions, reducing and carburizing gases are required. The reducing agents in town gas are: CH_4, H_2, CO, and C_nH_m.

The carburizing agents are: CH_4, CO_2, and C_nH_m.

It is tempting to assume that reducing the quantity of air will give the desired result. But it is impossible to obtain, naturally, a completely neutral atmosphere. A non-oxidizing atmosphere is obtained by having the air/gas ratio 2.5/1. The residual H_2, CH_4 and CO will stop the oxidizing action of CO_2 and H_2O, but it is practically impossible, by partial combustion, to obtain an atmosphere in which the decarburizing agents are weaker than carburizing agents; many

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 TELEGRAMS—STOKER MANCHESTER

LONDON OFFICE: COLUMBIA HOUSE, ALDWYCH, W.C.2 TELEPHONE: HOLBORN 4108-9 TELEGRAMS: WESGASCO ESTRAND

factors which cannot be controlled come into play. From the table, as the air/gas ratio increases, the percentages of H_2, CO_2, and CH_4 fall; and the percentages of CO_2, H_2O, and N_2 increase.

These circumstances tend to keep a balance on the decarburization side. N_2 is strongly decarburizing when water vapour is present. The tendency is towards decarburizing as the air/gas ratio is increased.

Lightly burnt town gas, as a furnace atmosphere, is actively decarburizing, even with low carbon steels, because of the hydrogen and water vapour present. Therefore, "bright" hardening is impossible in such an atmosphere. Even with air/gas=2/1, decarburization is still serious. A reducing atmosphere from town gas is generally decarburizing. If air/gas=3/1 the atmosphere is practically neutral to steel for oxidation, and the tendency to decarburization is much reduced. The oxidizing agents H_2O and CO_2 tend to neutralize the reducing agents H_2, CO, and CH_4.

When the proportion of air/gas is 3.5/1, the atmosphere is slightly oxidizing. Therefore, decarburization is replaced by a slight scaling tendency, which protects the surface.

(*To be continued*)

Gas Chemists' Manual of Dry Box Purification of Gas.*

Reviewed by "TAMT."

The form and method of preparation of this book is of particular interest to those who look forward to the production in this country of a text-book or series of text-books worthy of the birthplace of the Gas Industry, and commensurate with the commanding position in the sphere of town gas manufacture occupied by the British Gas Industry among those of the world. The revision of the Gas Chemists' *Handbook* of 1929 was itself compiled by a Committee of the American Gas Association. "During 1940, the Standing Committee for the revision of the Gas Chemists' *Handbook* was created by the Chemical Committee of the American Gas Association." This Committee invited Dr. Gilbert E. Seil "to prepare an authoritative working guide on matters relating to the removal of H_2S from gas through the medium of dry box purifiers." Dr. Seil's "original manuscript was reviewed by the members of the Committee and their ideas and suggestions were sent directly to the Author. The manuscript was re-written in 1942 and the final manuscript was prepared in 1943." That we suggest is a procedure which is calculated to obtain the best results both of individual treatment of the subject and of collaboration with the best expert opinion, very worthily represented in the list of the members of the Sub-Committee.

The need for the book is proved by the opening sentence of Dr. Seil's preface, a statement to which everyone will subscribe. "Although the removal of H_2S from manufactured gas is one of the oldest arts and has been practised for about 150 years, no real book has been published covering the methods used for this purpose."

The form of the book is refreshingly novel. Of its 289 pages, 86 cover the Author's treatment of the subject, the chemistry and physics of dry purification. The other 200 pages are devoted to an annotated bibliography, "which not only gives the name of the author, the title of the article, and the date and place of publication, but which also concisely states the contents of the article."

Here surely are suggestions which should be borne in mind by those entrusted with the preparation of the British text-book.

The treatment of the subject opens with a definition of terms, some of which are not used in this country. Part II treats the removal of H_2S by iron oxide and reveals many methods and practices which will be studied with profit by English engineers, who, however, will keep in mind that they must usually deal with gas of much higher H_2S content than appears to be common in the U.S.A. Particular attention is directed to the four methods of revivification which are described, and to the apparatus recommended for the continuous observation of temperature and pressure in the boxes. The recommended working temperature of between 85° and 100°F. is, we think, a little higher on the average than is generally accepted here, though it is to be feared that too many operators make no use of the means at their disposal of observing such temperatures. Under "Rotation" we were interested to note that "in the generally preferred system the box most badly fouled is the first in the line, with the cleanest box used as a catch box," whereas in this country the opposite, "backward," rotation appears to be preferred with the approval of the best authorities. Practical points of this nature caught our attention as engineers, but their discussion is a matter which we must leave to the chemists. To them we must also refer discussion of a reaction which appears to be accorded more importance than we had hitherto associated with it—namely, the catalytic oxidation of H_2S to sulphur and water in the presence of ferric sulphide, a reaction which simulates revivification in the boxes. "Practice has shown that the oxygen content of the gas must be over 0.4% and that the active iron oxide must be at least 15% fouled" before advantage can be taken of this reaction.

Part III is a short note on the elimination of the nitric oxide which gives rise to gum difficulties. "The fact that wood shavings absorb nitric oxide from the gas and then liberate it in the gas stream has been clearly demonstrated." "It is recommended that where vapour phase gums cause difficulty, revivified oxides be heated above 150°F. and blown with air until the outlet gas shows no nitric oxide before they are replaced in the purification line."

Part IV treats of the evaluation of gas-purifying material. Many tests for the analysis of the several materials and for their capacity and activity are described in full detail, some with Dr. Seil's own improvements. Tests for the determination of H_2S and HCN are also described. This section will be of more use to the chemist than to the engineer, but that, of course, is the chief purpose of the book. The nine conversion charts are very clearly drawn and printed.

The annotated bibliography covers not only dry box purification, but also liquid purification, other methods such as activated carbon, lime, and catalysis for the removal of sulphur compounds, naphthalene, organic sulphur, tar and tar-fog removal, nitric oxide, gum formation, cyanides—altogether 1801 abstracts covering practice and theory in every country in which these subjects have been studied and applied, the whole admirably printed and indexed—a perfect mine of reference. Each entry takes the form of an adequate abstract of the article or patent specification referred to. No published bibliography, however complete, can be right up-to-date, and it was not to be expected that this should extend to British Patent Specification No. 550,272, dated Dec. 31, 1943, granted to R. Walker, C. R. Wilkin, and H. G. Cooper, which describes plant in which the oxide is circulated as a sludge or slurry, and offers a promising solution to the problem of liquid purification.

One hankers for a succinct chapter treating specifically of plant design, even though such a chapter is not strictly within the scope of the book, and would in any case be of limited interest in British practice owing to the higher sulphur content of most of our gas, and the different characteristics of available oxides. But the bibliography enables even the designer, if he will, to pursue the subject into the all too diverse pathways of his own field.

The very high standard attained by this book is a reminder that the text-book shortly, we hope, to be produced in this country cannot afford to be conceived on any but the most impressive scale unless we wish to be hopelessly left behind by our American friends.

* By Gilbert E. Seil, pp. x + 289. American Gas Association, Inc., New York.

NOTES ON THE PROPOSED BRITISH GAS ASSOCIATION—

continued from p. 179.

British Gas Association and the appointment of a Director are matters of the greatest urgency and utmost priority. The submission of extensive observations on the proposals must inevitably result in delay, if they are to be given the detailed consideration which they deserve. It may well be, therefore, that the Association should be formed forthwith under a *skeleton Constitution*, leaving the formulation of more detailed and comprehensive regulations to a later, but no distant date. This has the advantage of enabling those concerned to benefit from the experience of the working of the Association during its early days, and of permitting more adequate consideration of the problems involved.

Diary

Feb. 12.—Scottish Junior Gas Association (Eastern District): Heriot-Watt College, Edinburgh, 3 p.m. Paper by H. B. Avery on "Purification."

Feb. 15.—Wales and Monmouthshire Junior Gas Association: General Meeting, offices of the Cardiff Gas Light & Coke Company, 2.30 p.m. Paper by W. R. Branson, M.Sc., Assoc.M.Inst.C.E.

Feb. 16.—Industrial Gas Centres Committee: Gas Industry House, 10 a.m.

Feb. 21.—London and Counties Coke Association: Gas Industry House. Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.

Feb. 26.—Manchester and District Junior Gas Association, Manchester: Paper on "Benzole Recovery with Activated Carbon," by R. Walker, H. C. Applebee, and A. K. Howell.

Feb. 26.—Yorkshire Junior Gas Association: General Meeting, Rawmarsh.

Feb. 28.—B.C.G.A. Domestic Heat Services Committee, Gas Industry House, 2.30 p.m.

Feb. 29.—Association of Gas Corporations: General Purposes Committee, Gas Industry House, 2.15 p.m.

Mar. 1.—Southern Association (Eastern District): Gas Industry House, 2.30. Discussion to be opened by Mr. C. H. Chester, O.B.E.

Mar. 3.—London and Southern District Junior Gas Association: Gas Industry House.

Mar. 21.—Southern Association: Committee, 11.30 a.m.; Luncheon, 1 p.m.; Annual General Meeting, 2.30 p.m. Holborn Restaurant, W.C. 1. Presidential Address of R. C. Taylor, M.B.E.

Mar. 25.—Western Junior Gas Association, Bristol: Paper on "High Pressure Storage and Distribution," by B. G. Hawkins.

Mar. 29.—London and Southern District Junior Gas Association: Gas Industry House.